UNIT 24  Solving Quadratic Equations

1. Factorise fully $3t + 6t^2$.  
(2 marks)

2. Solve the equation $12x^2 - 25x + 12 = 0$  
(4 marks)

3. (a) The expression
   
   $$x^2 - 6x + 7$$
   
   can be written in the form $(x + a)^2 + b$, where $a$ and $b$ are constants.
   
   Determine the values of $a$ and $b$ and hence find the minimum value of the expression.  
   (4 marks)

   (b) The solutions of the equation
   
   $$x^2 - 6x + 7 = 0$$
   
   can be written in the form $x = p \pm q\sqrt{2}$ where $p$ and $q$ are rational numbers.
   
   Determine the values of $p$ and $q$.  
   (3 marks)

4. Solve the equation $2x^2 + 3x - 2 = 0$  
(CXC) (3 marks)

5. Solve for $x$, given $3x^2 - 7x + 2 = 0$  
(CXC) (4 marks)

6. Solve the equation $x^2 = 4x + 9$, giving your answer to 3 significant figures.  
(5 marks)

7. (a) Using 1 cm to represent 1 unit on both the $x$ and $y$ axes, draw the graph of
   
   $$y = x^2 - 3x + 1 \text{ for } -3 \leq x \leq 3$$
   
   (5 marks)

   (b) (i) Express $x^2 - 3x + 1$ in the form $(x - p)^2 + q$.  
   (3 marks)

   Hence determine

   (ii) the minimum value of $x^2 - 3x + 1$  
   (1 mark)

   (iii) the value of $x$ for which $x^2 - 3x + 1$ takes the minimum value.  
   (CXC) (1 mark)
UNIT 24 Solving Quadratic Equations

CSEC Revision Test

8. (a) Write \( 5x^2 + 2x - 7 \) in the form \( a(x + b)^2 + c \), where \( a, b \) and \( c \) are real numbers. (4 marks)

(b) Hence, or otherwise, determine
   (i) the minimum value of the function \( y = 5x^2 + 2x - 7 \)
   (ii) the value of \( x \) at which the minimum occurs. (3 marks)

(c) Find the values of \( x \) for which \( 5x^2 + 2x - 7 = 0 \) (3 marks)

(d) Sketch the graph of \( y = 5x^2 + 2x - 7 \), clearly showing
   (i) the coordinates of the minimum point
   (ii) the value of the y-intercept
   (iii) the points where the graph cuts the y-axis. (CXC) (5 marks)

(50 MARKS)
### UNIT 24 Solving Quadratic Equations

<table>
<thead>
<tr>
<th>Question</th>
<th>Equation</th>
<th>Solutions</th>
<th>CSEC Revision Test</th>
<th>Answers</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>$3t(1 + 2t)$</td>
<td>(B1 for just $t$ or just 3 factor)</td>
<td>B2</td>
<td>(2 marks)</td>
</tr>
<tr>
<td>2.</td>
<td>$(4x - 3)(3x - 4) = 0$</td>
<td></td>
<td>M2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$x = \frac{3}{4}$ or $\frac{4}{3}$</td>
<td></td>
<td>A1 A1</td>
<td>(4 marks)</td>
</tr>
<tr>
<td>3.</td>
<td>$(x - 3)^2 - 2$</td>
<td>$a = -3, b = -2, \text{ minimum } = -2$</td>
<td>B1 B1 B2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$x = 3 + \sqrt{2}$ or $3 - \sqrt{2}$</td>
<td></td>
<td>B1</td>
<td>(7 marks)</td>
</tr>
<tr>
<td>4.</td>
<td>$(2x - 1)(x + 2) = 0$</td>
<td></td>
<td>M1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$2x - 1 = 0$ or $x + 2 = 0$</td>
<td></td>
<td>A1</td>
<td>(3 marks)</td>
</tr>
<tr>
<td></td>
<td>$x = \frac{1}{2}$ or $x = -2$</td>
<td></td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>$(3x - 1)(x - 2) = 0$</td>
<td></td>
<td>M1 A1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$3x - 1 = 0$ or $x - 2 = 0$</td>
<td></td>
<td>A1</td>
<td>(4 marks)</td>
</tr>
<tr>
<td></td>
<td>$x = \frac{1}{3}$ or $x = 2$</td>
<td></td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>$x^2 - 4x - 9 = 0$</td>
<td>$a = 1, b = -4, c = -9$</td>
<td>M1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$x = \frac{4 \pm \sqrt{(-4)^2 - 4 \times 1 \times (-9)}}{2 \times 1}$</td>
<td></td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$x = \frac{4 \pm \sqrt{52}}{2} = 2 \pm \sqrt{13}$</td>
<td></td>
<td>A1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$x = 5.61$ and $-1.61$</td>
<td></td>
<td>B1 B1</td>
<td>(5 marks)</td>
</tr>
<tr>
<td>7.</td>
<td>(a) Graph</td>
<td></td>
<td>B5</td>
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<tr>
<td></td>
<td>(b)</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(i) $(x - \frac{3}{2})^2 - \frac{5}{4}$</td>
<td></td>
<td>M1 A1 A1</td>
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<td></td>
<td>(ii) $-\frac{5}{4}$</td>
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<td>B1</td>
<td></td>
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<td></td>
<td>(iii) $\frac{3}{2}$</td>
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<td>B1</td>
<td>(10 marks)</td>
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UNIT 24  \textit{Solving Quadratic Equations}  

8.  \(5 \left( x + \frac{1}{5} \right)^2 - \frac{36}{5}\)  

\begin{align*}
\text{(a)} &\quad 5 \left( x + \frac{1}{5} \right)^2 - \frac{36}{5} \\
\text{(b)} &\quad \text{(i)} - \frac{36}{5} \\
&\quad \text{(ii)} - \frac{1}{5} \\
\text{(c)} &\quad \left( x + \frac{1}{5} \right)^2 = \frac{36}{25} \Rightarrow x = - \frac{1}{5} \pm \frac{6}{5} \\
&\quad x = 1 \quad \text{or} \quad - \frac{7}{5} \\
\text{(d)} &\quad \text{B1 for graph} \\
&\quad \text{B1 B1 B1 B1 for each point} \\
&\quad (15 \text{ marks})
\end{align*}